

DESCRIPTIONBACILLUS THURINGIENSIS TOXINS WITH IMPROVED ACTIVITYCross-Reference to Related Applications

RP  
3/8/04 [0001] This is a continuation of U.S. Patent Application Serial No. 09/222,594, filed December 28, 1998, which is a divisional of U.S. Patent Application Serial No. 08/904,278, filed July 31, 1997, now U.S. Patent No. 5,874,288.  
now US Patent 6,303,364

Background of the Invention

70002] Insects and other pests cost farmers billions of dollars annually in crop losses and in the expense of keeping these pests under control. The losses caused by pests in agricultural production environments include decrease in crop yield, reduced crop quality, and increased harvesting costs.

70003] Coleopterans are an important group of agricultural pests which cause a very large amount of damage each year. Examples of coleopteran pests include alfalfa weevils and corn rootworm.

70004] The alfalfa weevil, *Hypera postica*, and the closely related Egyptian alfalfa weevil, *Hypera brunneipennis*, are the most important insect pests of alfalfa grown in the United States, with 2.9 million acres infested in 1984. An annual sum of 20 million dollars is spent to control these pests. The Egyptian alfalfa weevil is the predominant species in the southwestern U.S., where it undergoes aestivation (*i.e.*, hibernation) during the hot summer months. In all other respects, it is identical to the alfalfa weevil, which predominates throughout the rest of the U.S.

[0005] The larval stage is the most damaging in the weevil life cycle. By feeding at the alfalfa plant's growing tips, the larvae cause skeletonization of leaves, stunting, reduced plant growth, and, ultimately, reductions in yield. Severe infestations can ruin an entire cutting of hay. The adults, also foliar feeders, cause additional, but less significant, damage.

[0006] Approximately 9.3 million acres of U.S. corn are infested with corn rootworm species complex each year. The corn rootworm species complex includes the northern corn rootworm, *Diabrotica barberi*, the southern corn rootworm, *D. undecimpunctata howardi*, and the western